

CECW-ED/ CECW-OM  Engineer Regulation 1110-2-111	Department of the Army U.S. Army Corps of Engineers Washington, DC 20314-1000	ER 1110-2-111  30 April 1997
	Engineering and Design  PERIODIC SAFETY INSPECTION AND CONTINUING EVALUATION OF USACE BRIDGES	
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## **Errata Sheet**

### **No. 1**

#### **ENGINEERING AND DESIGN**

Periodic Safety Inspection and Continuing  
Evaluation of USACE Bridges

**ER 1110-2-111**

**30 April 1997**

1) Page 1. Replace reference g with the following:  
“Culvert Inspection *Manual*,” Report No. FHWA-IP-86-2, July 1986, supplement to  
Reference 3d.

**2) Page 3.** Replace first line of paragraph 8b( 1) with the following:  
(1) Reviewing and monitoring the data collection,

**Engineering and Design**  
**PERIODIC SAFETY INSPECTION AND CONTINUING**  
**EVALUATION OF USACE BRIDGES**

**1. Purpose**

This regulation defines the policy and prescribes procedures and responsibilities for the periodic inspection and evaluation of bridges owned or maintained by the U.S. Army Corps of Engineers (USACE) on civil works projects.

**2. Applicability**

This regulation applies to all USACE Commands having civil works responsibilities.

**3. References**

a. 23 F.R. 650, National Bridge Inspection Standards, dated October 1988 (see Appendix A of this ER).

b. ER 1110-2-101, Reporting of Evidence of Distress of Civil Works Structures.

c. EM 1110-2-2002, Evaluation and Repair of Concrete Structures.

d. "Bridge Inspector's Training Manual/90," July 1991 (Revised March 1995), Federal Highway Administration, 6300 Georgetown Pike, McLean, VA, 22101.

e. "Bridge Inspector's Manual for Movable Bridges," Report No. FHWA-IP-77-10, 1977, supplement to Reference 3d.

f. "Construction and Maintenance Section," American Railway Engineering Association, Volumes I & II.

g. "Culvert Inspection Manual," Report No. FHWA-IP-86-2, July 1986, supplement to Reference 3d.

h. "Inspection of Fracture Critical Bridge Members," Report No. FHWA-DP-80-1, September 1980, supplement to Reference 3d.

i. "Manual for Maintenance Inspection of Bridges," American Association of State Highway and Transportation Officials, 444 North Capitol Street, Washington, DC, 20001 (latest edition).

j. "Manual for Railway Engineering," American Railway Engineering Association, Volumes I & II (latest edition).

k. "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges," Design and Inspection Branch, Bridge Division, Federal Highway Administration, Washington, DC (latest edition).

l. "Standard Specifications for Highway Bridges," American Association of State Highway and Transportation Officials, 1992.

m. "Underwater Inspection of Bridges," Report No. FHWA-DP-80-1, Final Report, November 1989.

n. "USACE Bridge Inventory System," September 1992.

o. "Evaluating Scour at Bridges," Hydraulic Engineering Circular (HEC) 18, Federal Highway

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This regulation supersedes ER 1110-2-111, dated 31 December 1992.

Administration, Report No. FHWA-IP-90-017, November 1995.

p. “*Stream Stability at Highway Structures*,” Hydraulic Engineering Circular (HEC) 20, Federal Highway Administration, Report No. FHWA-IP-90-014, November 1995.

q. “*Manual for Condition Evaluation of Bridges*,” American Association of State Highway and Transportation Officials, 444 North Capitol Street, Washington, DC 20001, 1994.

r. “*Seismic Retrofitting Manual for Highway Bridges*,” FHWA-RD-94-052, May 1995.

#### 4. Background

The Surface Transportation Assistance Act of 1978 (PL 100-17) requires that all structures defined as bridges (see reference 3a) on public roads be inventoried and inspected in accordance with the National Bridge Inspection Standards (NBIS). Under the standards, each state is required to record and maintain structure inventory and appraisal data on each bridge and submit the data to the Federal Highway Administration upon request.

#### 5. Policy

All bridges (see part 650.301 of reference 3a for definition) owned or maintained by USACE on civil works projects shall be inspected and inventoried to ensure their safety and structural integrity.

a. Public highway bridges with spans greater than 6.1 m (20 ft) shall be inspected and evaluated in compliance with the NBIS.

b. Railway bridges shall be inspected and evaluated in accordance with references 3d through 3j, and 3m.

c. Access bridges to outlet works, or dam service bridges which are closed to the public, foot/pedestrian bridges, and all bridges on public roads with spans of 6.1 m (20 ft) or less shall be inspected and evaluated in accordance with a comprehensive, uniform plan approved by each Major Subordinate Command (MSC) in consultation with HQUSACE (CECW-ED).

d. An inventory of subject bridges (public highway, railroad, foot/pedestrian, access bridges to outlet works and dam service bridges) shall be prepared and maintained in accordance with the Corps of Engineers USACE Bridge Inventory System (CEBIS), reference 3n, except pedestrian walkways or passageways which provide internal access in civil works structures. The CEBIS is composed of three database files: the Structure Inventory and Appraisal (SI&A), the Inspection Sheet, and the Maintenance Sheet.

e. All existing bridges over tidal and nontidal waterways should be evaluated for the risk of failure from scour during the occurrence of a flood on the order of magnitude of the 500-year return period. Bridge scour evaluations shall be conducted for each bridge to determine whether it is scour critical in accordance with references 3o and 3p.

f. Fracture critical members (FCM) of any bridge shall be identified and recorded in the bridge inspection report and CEBIS. An inspection plan of FCM shall be developed and executed. See Appendix B for more guidance.

g. Bridge seismic evaluations and retrofitting requirements shall be conducted in accordance with sections 1.4 and 1.5 of reference 3r.

h. Seismic zones and soil types for each bridge shall be identified and recorded in the bridge inspection report and CEBIS.

i. HQUSACE (CECW-ED) shall send consolidated SI&A data of USACE public highway bridges to the Federal Highway Administration (FHWA) to comply with the NBIS.

#### 6. Types of Safety Inspections

Inspection during the service life of the bridge includes an initial inventory inspection after construction is complete, periodic routine inspections, special inspection to evaluate damage or deterioration, or to monitor performance, and underwater inspections which require special equipment for access. Types of inspections are described in Appendix C.

## 7. Frequency of Inspections

A routine inspection shall be conducted every two years unless the condition of the bridge indicates that more frequent inspections are required. Other types of inspection and their frequencies will depend upon the age, present load capacity, traffic, type of construction, state of maintenance, and any known deficiencies related to fatigue, scour, seismic influences, fracture of critical members, and corrosion. Evaluation of bridge condition shall be the responsibility of the structural engineer in charge of the inspection program. The maximum inspection interval may be increased for bridges if past inspection reports and favorable experience and analysis justify it. Maximum inspection intervals of four years and five years between inspections are permitted for the bridges described in paragraphs 5a and 5c, respectively. Proposals to inspect bridges at intervals greater than two years shall be submitted for approval with supporting data through the MSC to CECW-ED for the bridges described in paragraph 5a, and to the MSC for the bridges described in paragraph 5c. The plan for inspecting any bridge at intervals greater than two years should be based on the type and frequency of vehicular traffic (i.e., with tires, treads, or on a track) which may cause fatigue or deterioration of the structural members. Actual inspections or reports should be performed in the most cost-effective manner. Special inspections are necessary after bridges experience significant events such as hurricanes, earthquakes, fires, floods, or collisions. Underwater bridge members shall be inspected to the extent necessary to determine the condition and structural integrity of the bridge. An underwater inspection of all substructures shall be performed at an interval not to exceed five years.

## 8. Organizational Responsibilities

HQUSACE, MSC, and District responsibilities require teamwork between engineering and operations divisions at all levels, and with the U.S. Army Engineer Waterways Experiment Station (WES). The responsibilities are described below.

*a. District.* The engineering divisions shall be responsible for the following activities:

(1) Formulating the inspection plans, conducting the inspections, processing and analyzing the results of the instrument observations, evaluating the condition of the bridges, determining scope and frequency of future

inspections, and preparing and submitting the periodic inspections reports.

(2) All inspection reports shall be certified by the district and submitted by the District Commander to the MSC Commander (or to the delegated approval authority) for certification of quality assurance and approval (Part 2 of Appendix D) within 60 days after the inspection.

(3) Preparing, maintaining, and updating the District CEBIS.

(4) Inviting a representative from the operations division to participate in each inspection. For those bridges being inspected for the first time, a representative from the construction division shall be invited to participate.

(5) Coordinating with operations division on the annual Operations and Maintenance (O&M) budget process for funding existing bridge inspections, evaluations, repairs, improvements, or rehabilitation related to bridge safety.

(6) Notifying any city, county, state, or local government and operating railway company which has jurisdiction of the road of the inspection.

*b. MSC.* The engineering directorates shall be responsible for the following activities:

(1) Reviewing and monitoring the data collection, processing, evaluation, and inspection activity; maintaining the schedule of inspections and status of reports; and establishing procedures to promptly inform CECW-ED and CECW-OM when the evaluation of a bridge or instrumentation data indicate that a bridge is unsafe.

(2) Coordinating with operations division on the annual O&M budget process for funding existing bridge inspections, evaluations, repairs, improvements, or rehabilitation related to bridge safety.

(3) MSC Commanders are authorized to approve inspection reports, except as specifically stated below. Districts and operating MSCs shall perform an independent technical review. If the MSC decides to delegate approval authority to the districts, then it should retain responsibility for program management and oversight. Review and approval of reports should be completed within 120 days after completion of the field inspection. This period should include satisfactory resolution of all

review comments. Reports shall be sent to CECW-ED for review and approval, with the views and recommendations of the MSC Commander included in the transmittal correspondence only under the following circumstances:

(a) Views and recommendations are requested by HQ representative at the inspection.

(b) Bridge inspection indicates that the safety of a bridge is in jeopardy and requires posting, as described in paragraph 10i.

(4) An information copy of each approved report shall be furnished to CECW-ED, including submittal and approval correspondence.

(5) The MSC Commander shall consolidate District CEBIS into MSC CEBIS and submit to CEWES-ID before 1 February of each calendar year.

(6) MSC Commander shall maintain and update the MSC CEBIS.

(7) A qualified structural engineer, responsible for the bridge inspection safety program at the MSC/district, should be designated as the point of contact for CEBIS, inspection, report, maintenance, repair, and rehabilitation of bridges.

(8) MSC is responsible for development of a Quality Assurance Program and for completion of Part 2 of Appendix D.

*c. HQUSACE.* CECW-ED shall be responsible for the following activities:

(1) Overseeing engineering management of all phases of the USACE Bridge Safety Program.

(2) Coordinating with CECW-OM on the annual O&M budget process for funding existing bridge inspections, evaluations, repairs, improvements, or rehabilitation related to bridge safety.

(3) Developing engineering guidance for implementing a Bridge Safety Program covering public access bridges and other USACE bridges.

(4) Providing policy advice to HQUSACE elements on any new legislation related to the safety of USACE bridges.

(5) Providing policy compliance review of all decision documents related to bridge safety deficiencies.

(6) Acting as proponent for training needs of USACE bridge engineers and coordinating the training effort with courses offered by FHWA and American Association of State Highway and Transportation Officials (AASHTO).

(7) Acting as liaison with state and other Federal agencies to evaluate procedures and capabilities with respect to bridge safety.

*d. Waterways Experiment Station.* The WES Information Technology Laboratory shall be responsible for the following activities:

(1) Developing a Bridge Management System (BMS) that uses database diskettes furnished to MSCs and districts upon request.

(2) Consolidating and compiling the data from all district inspection reports and MSC CEBIS into the computer database, compiling SI&A data of USACE public highway bridges, and submitting to CECW-ED for reporting to FHWA before 15 March of each calendar year.

(3) Providing CEBIS report to HQUSACE, MSCs, districts, and other USACE installations upon request.

## **9. Qualifications of Bridge Inspector's Team**

*a. Structural engineer.* The structural engineer in charge of the bridge inspection and evaluation program shall be a registered professional engineer and shall meet the minimum qualifications stated in paragraph 650.307 of reference 3a and have completed a comprehensive training course based on the current version of reference 3d.

*b. Field inspection team.* All field inspections shall be performed by a team consisting of a team leader and at least one bridge technical specialist.

(1) The team leader shall be a structural engineer (registered professional engineer) who meets the minimum qualifications stated in paragraph 650.307 of reference 3a and have completed a comprehensive training course based on the current version of reference 3d.

(2) Bridge technical specialists shall meet the following minimum qualifications:

(a) Have a Bachelor of Science Degree in Civil Engineering, or

(b) Have an Associate Degree in Civil Engineering Technology, and have completed a comprehensive training course in “*Engineering Concepts for Bridge Inspectors*” based on the current version of reference 3d.

(3) The mechanical and electrical engineers involved with the inspection of movable bridges (swing, bascule, and vertical lift bridges) shall be registered professional engineers who are proficient with the methods and procedures described in Chapter 20, reference 3d.

*c. Underwater inspections and scour evaluation.* Underwater inspectors must have knowledge and experience in bridge inspection. A diver not fully qualified as a bridge inspector or bridge inspection team leader must be used only under close supervision. Hydraulic and geotechnical engineers involved with the bridge scour evaluation should be registered professional engineers who are proficient in the methods described in references 3o and 3p or have successfully completed the FHWA’s training course, “Stream Stability and Scour at Highway Bridges.” All underwater inspections and scour evaluations shall be conducted under the direct supervision of a qualified bridge inspection team leader.

*d. Independent technical review.* Reviewers shall be senior engineers who have the proper knowledge, skills, training, and experience; and who were not directly involved in the inspection or report preparation. The reviewers’ qualifications shall not be less than those stated in paragraph 9a, and they must have current experience in inspecting and evaluating several bridges. Names and qualifications of the reviewers should be included in the district’s quality control (QC) plans, and be approved by the MSC as part of its quality assurance (QA) program.

## 10. Inspection Procedures

A 5-year bridge inspection program budget and schedule shall be developed. Condition, age, size, and traffic are some of the parameters to consider in establishing priorities for the inspection plan. A copy of this plan is

to be furnished through the MSC to CECW-ED by 15 February of each year.

*a. Notification of inspections.* CECW-ED shall be notified, through the MSC, at least 30 days in advance of a scheduled inspection in order to determine whether an HQ representative(s) will participate in the inspection.

*b. Procedures for underwater and fracture-critical members.* See Chapters 17 and 18 of reference 3d for details.

*c. Procedures for inspection and evaluation of structure.* See Chapters 7-14 of reference 3d for details.

*d. Procedures for inspection of movable bridges.* See Chapter 20 of references 3d and 3e for details.

*e. Inspection of segmental concrete bridges, cable-stayed bridges, and suspension bridges.* See Chapter 21 of reference 3d for details.

*f. Procedures for evaluating scour at bridges.* See references 3o and 3p for details.

*g. Highway bridge load capacity rating.* Each USACE bridge that is subject to NBIS inspection provisions shall be rated for safe load-carrying capacity. The capacity of all highway bridges shall be rated at two levels. The upper load level is referred to as the operating rating, and the lower load level is referred to as the inventory rating. Load ratings for bridge members shall be made in accordance with references 3i or 3q.

(1) A load capacity rating shall be performed as part of:

(a) The initial inventory inspection.

(b) Periodic routine inspections if rating is not available in records.

(c) Special inspection after bridges experience significant events such as hurricanes, earthquakes, fires, floods, or collisions.

(2) A load rating shall be performed whenever the dead load from the bridge surface has increased due to a major rehabilitation or replacement of the decking.

(3) All load ratings shall be based on both the AASHTO "HS" and "H" analysis vehicle configurations. Both the AASHTO "HS" and "H" truck load and lane loads shall be used to determine the rating values.

(4) If the inventory rating as defined by the AASHTO manual based on the "HS" vehicle loading equals or exceeds HS-20 33 tonnes (36 tons), it is not necessary to compute ratings based on the "H" loading.

*h. Railway bridge rating.* Evaluation of load capacity for railway bridges shall be determined in accordance with reference 3j.

*i. Highway bridge posting.* Posting a bridge for load-carrying capacity is required when the maximum legal load exceeds the operating rating capacity. Districts may choose to post an inventory rating capacity. If the bridge condition requires reducing the posted limit to less than 2.7 tonnes (3 tons), the bridge shall be closed for vehicular traffic.

## 11. Inventory and Inspection Report

*a. Report preparation.* A formal technical report shall be a permanent record and will serve as a basis for determining the need for remedial work. The report will be based on a detailed inspection and evaluation of each bridge as to its safety and structural adequacy. As a minimum, the report shall contain the results of the inspection and recommendations for remedial work, approximate total cost, and a scheduled completion date of any remedial work. In order to more accurately portray conditions and changes in conditions of surfaces and structural details, photographs are generally required. Photographs shall be provided of all areas requiring visual monitoring or critical regions of structural distress. The CEBIS printout shall be part of the inspection report. Report contents and format shall be as shown in Appendix E.

*b. Report review and certification.* All bridge inspection and evaluation reports shall receive an independent technical review. The district or operating MSC shall certify that the inspection and evaluation were performed in accordance with this regulation and the referenced criteria by qualified engineers, and that all remedial work necessary to assure that the safety of

the bridge is not jeopardized is being developed on an appropriate schedule. See Appendix D for certification and approval.

*c. Report distribution.* One copy of each approved report shall be submitted by the originating office through the MSC to CECW-ED. An additional copy of each approved report shall be submitted by the originating office to CEWES-ID.

*d. Inventory preparation.* Each district shall prepare and maintain a District CEBIS of all its bridges. The District CEBIS includes the SI&A data shown in Appendices F and G. Newly completed structures, physical changes to existing structures which would alter previously recorded data, and placement of load and/or speed restriction signs shall be entered in the District CEBIS within 60 days after the change in condition. The MSC shall update and forward the MSC CEBIS data to CECW-ED and also furnish a copy to CEWES-ID within 30 days after receiving district updates.

*e. CEBIS distribution.* The District Commander shall submit one copy (diskette) of the District CEBIS to the MSC. The MSC shall consolidate all District CEBIS into MSC CEBIS and forward one copy to CEWES-ID. CEWES-ID shall consolidate all MSC CEBIS into civil works CEBIS and forward to CECW-ED.

## 12. Reporting Distress

If the bridge inspection and evaluation indicate evidence of distress or potential failure requiring immediate remedial action, the district shall inform CECW-E and CECW-O immediately through the MSC office. Emergency situations will be handled in accordance with the guidance set forth in reference 3b.

## 13. Interagency Coordination

In those cases where ownership of major elements is divided between the Corps and other agencies, information pertinent to the condition of project elements owned by others, as observed by the Corps inspection team, shall be furnished to the co-owner for information purposes only.

#### 14. Funding

Requests for funding of bridge inspections, maintenance, and repair shall be prioritized and submitted to CECW-OM as part of the annual O&M budget process.

FOR THE COMMANDER:

##### 7 Appendices

APP A - National Bridge Inspection Standard

APP B - Fracture Critical Members (FCM)

APP C - Description of Inspection Types

APP D - Statement of Inspection

Review and Approval

APP E - Inspection Report Format and Content

APP F - Highway Bridge SI&A Sheet

APP G - Railway Bridge SI&A Sheet



OTIS WILLIAMS

Colonel, Corps of Engineers

Chief of Staff

## APPENDIX A NATIONAL BRIDGE INSPECTION STANDARD

Excerpts from the Code of Federal Regulations  
23 Highways - Part 650

Subpart C National Bridge Inspection Standards (NBIS)

### §650.301 Application of Standards.

The National Bridge Inspection Standards in this appendix apply to all structures defined as bridges located on all public roads. In accordance with the AASHTO (American Association of State Highway and Transportation Officials) Transportation Glossary, a “bridge” is defined as a structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 6.1 m (20 ft) between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening.

### §650.303 Inspection Procedures.

(a) Each highway department shall include a bridge inspection organization capable of performing inspections, preparing reports, and determining ratings in accordance with the provisions of the AASHTO Manual<sup>1</sup> and the Standards contained herein.

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<sup>1</sup> The AASHTO Manual referred to in this part is the *Manual for Maintenance Inspection of Bridges* (1983), together with subsequent interim changes or the most recent version of the AASHTO Manual published by the American Association of State Highway and Transportation Officials. A copy of the manual may be examined during normal business hours at the office of each Division Administrator of the Federal Highway Administration, at the office of each Regional Federal Highway Administrator, and at the Washington Headquarters of the Federal Highway Administration. The addresses of those document inspection facilities are set forth in Appendix D to Part 7 of the regulations of the Office of the Secretary (40 CFR Part 7). In addition, a copy of the manual may be secured upon payment in advance by writing to the American Association of State Highway and Transportation Officials, 444 N. Capitol Street NW, Suite 225, Washington, DC 20001.

(b) Bridge inspectors shall meet the minimum qualifications stated in §650.303.

(c) Each structure required to be inspected under the Standards shall be rated as to its safe load-carrying capacity in accordance with Section 4 of the AASHTO manual. If it is determined under this rating procedure that the maximum legal load under state law exceeds the load permitted under the Operating Rating, the bridge must be posted in conformity with the AASHTO Manual or in accordance with state law.

(d) Inspection records and bridge inventories shall be prepared and maintained in accordance with the Standards.

(e) The individual in charge of the organizational unit that has been delegated the responsibilities for bridge inspection, reporting, and inventory shall determine and designate on the individual inspection and inventory records and maintain a master list of the following:

(1) Those bridges which contain fracture-critical members, the location and description of such members on the bridge and the inspection frequency and procedures for inspection of such members. (Fracture-critical members are tension members of a bridge whose failure will probably cause a portion of or the entire bridge to collapse.)

(2) Those bridges with underwater members which cannot be visually evaluated during periods of low flow or examined by feel for condition, integrity, and safe load capacity due to excessive water depth or turbidity. These members shall be described, the inspection frequency stated, not to exceed 5 years, and the inspection procedure specified.

(3) Those bridges which contain unique or special features requiring additional attention during inspection to ensure the safety of such bridges and the inspection frequency and procedure for inspection of each such feature.

(4) The date of last inspection of the features designated in paragraphs (e)(1) through (e)(3) of this section and a description of the findings and follow-up actions, if necessary, resulting from the most recent inspection of fracture-critical details, underwater members, or special features of each bridge so designated.

#### **§650.305 Frequency of Inspections.**

(a) Each bridge is to be inspected at regular intervals not to exceed 2 years in accordance with Section 2.3 of the AASHTO Manual.

(b) Certain types or groups of bridges will require inspection at less than 2-year intervals. The depth and frequency to which bridges are to be inspected will depend on such factors as age, traffic characteristics, state of maintenance, and known deficiencies. The evaluation of these factors will be the responsibility of the individual in charge of the inspection program.

(c) The maximum inspection interval may be increased for certain types or groups of bridges where past inspection reports and favorable experience and analysis justify the increased interval of inspection. If a state proposes to inspect some bridges at greater than the specified 2-year interval, the state shall submit a detailed proposal and supporting data to the Federal Highway Administrator for approval.

#### **§650.307 Qualifications of Personnel.**

(a) The individual in charge of the organizational unit that has been delegated the responsibilities for bridge inspection, reporting, and inventory shall possess the following minimum qualifications:

(1) Be a registered professional engineer; or

(2) Be qualified for registration as a professional engineer under the laws of the state; or

(3) Have a minimum of 10 years of experience in bridge inspection assignments in a responsible capacity and have completed a comprehensive training course based on the *Bridge Inspector's Training Manual*,<sup>2</sup>

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<sup>2</sup> The *Bridge Inspector's Training Manual* may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

which has been developed by a joint Federal-state task force, and subsequent additions to the manual.<sup>3</sup>

(b) An individual in charge of a bridge inspection team shall possess the following minimum qualifications:

(1) Have the qualifications specified in paragraph (a) of this section; or

(2) Have a minimum of 5 years experience in bridge inspection assignments in a responsible capacity and have completed a comprehensive training course based on the *Bridge Inspector's Training Manual*, which has been developed by a joint Federal-state task force.

(3) Current certification as a Level III or IV Bridge Safety Inspector under the National Society of Professional Engineer's program for National Certification in Engineering Technologies (NICET)<sup>4</sup> is an alternative acceptable means for establishing that a bridge inspection team leader is qualified.

#### **§650.309 Inspection Report.**

The findings and results of bridge inspection shall be recorded on standard forms. The data required to complete the forms and the functions which must be performed to compile the data are contained in Section 3 of the AASHTO Manual.

#### **§650.311 Inventory.**

(a) Each state shall prepare and maintain an inventory of all bridge structures subject to the Standards.

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<sup>3</sup> The following publications are supplements to the *Bridge Inspector's Training Manual*: *Bridge Inspector's Manual for Movable Bridges*, 1977, GPO Stock No. 050-002-00103-5; *Culvert Inspector's Training Manual*, July 1986, GPO Stock No. 050-001-0030-7; and *Inspection of Fracture Critical Bridge Members*, 1986, CPO Stock No. 050-001-00302-3.

<sup>4</sup> For information on NICET program certification, contact: National Institute for Certification in Engineering Technologies, 1420 King Street, Alexandria, Virginia 22314. Phone (703) 684-2835.

Under these Standards, certain structure inventory and appraisal data must be collected and retained within the various departments of the state organization for collection by the Federal Highway Administration, as needed. These data are tabulated in the structure inventory and appraisal sheet distributed by the Federal Highway Administration as part of the Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges (Coding Guide) in January of 1979. Reporting procedures have been developed by the Federal Highway Administration.

(b) Newly completed structures, modification of existing structures which would alter previously

recorded data on the inventory forms, or placement of load restriction signs on the approaches to or at the structure itself shall be entered in the state's inspection reports and the computer inventory file as promptly as practical but no later than 90 days after the change in the status of the structure for bridges directly under the state's jurisdiction and no later than 180 days after the change in status of the structure for all other bridges on public roads within the state.

Effective date October 25, 1988.

## APPENDIX B FRACTURE CRITICAL MEMBERS (FCM)

The U.S. Army Corps of Engineers has adapted the American Association of State Highway and Transportation Officials' guidelines for fracture critical members (FCM) on all steel bridges stated in the "Manual for Condition Evaluation of Bridges."

*"Fracture critical members or member components are tension members or tension components of members whose failure would be expected to result in collapse of a bridge."*

Tension components of a bridge member consist of components of tension members and those portions of a flexural member that are subject to tension stress. Any attachment having a length in the direction of the tension stress greater than 100 mm (4 in.) that is welded to the tension area of a component of a "fracture critical" member shall be considered part of the tension component and therefore, shall be considered "fracture critical."

Not all tension members are FCM. Redundant tension members are not FCM. Redundancy means that should a tension member or its component fail, the load carried by the failed member could be redistributed to other members which have reserve capacity to temporarily carry additional load, and avoid catastrophic collapse of the structure. For recommended procedures for identification of FCM, see other Corps publications.

FCMs have all or part of their cross section in tension. Most cracks in steel members occur in the tension zones, generally at a flaw or defect in the base material. Frequently the crack is a result of fatigue, occurring near a weld, a material flaw, and/or changes in member cross section.

After the crack occurs, failure of the member could be sudden and would lead to the collapse of the bridge. For this reason, steel bridges with the following structural characteristics or components should receive special attention during inspection:

- One- or two-girder systems, including single boxes with welding.
- Suspension systems with two eyebar components.

- Steel pier caps and cross girders.
- Two-truss systems.
- Suspended spans with two girders.
- Welded tied arches.
- Pin and hanger connections on two- or three-girder systems.

Inspection of steel bridges should include the identification of fracture critical members and the development of a plan for inspecting such members. The FCM inspection plan should identify the inspection frequency and procedures to be used. A very detailed close visual "hands-on" inspection in the field is the primary method of detecting cracks. This requires that critical areas be specially cleaned prior to the inspection and additional lighting and magnification be used. Other non-destructive testing procedures (see Chapter 18 of reference 3d) should be used for members which are not accessible for close visual contact or for examination of suspected cracks or flaws on welded members. Photographs and sketches should be made of the conditions found and onsite comparisons of photographs and sketches should be made at follow-up inspections.

The FCM inspection plan for each bridge shall be developed by a qualified bridge inspector who should decide the frequency, methods, and procedures of the inspection.

Initial inspection of FCM should be conducted thoroughly for each welded or bolted joint and connection. The condition of the inspected members should be recorded clearly in the report. The report should include assessments and recommendations for follow-up inspections of the members. Recommendations should include the frequency, methods, and procedures of the inspection. A maximum inspection interval of 6 years is permitted if the inspected and assessed FCMs were in good condition and an evaluation of fatigue life shows that the member is not approaching its useful limit. See reference 3d, Chapter 18, for more detailed information on FCM inspection and evaluation. For routine biennial inspection, FCM should be inspected and reported not less than other structural members.

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When cracks are detected in an FCM, the inspection should be supplemented by a fatigue evaluation of the member. The evaluation should be used to determine the remaining useful life, the critical crack size, and can follow the procedures outlined in other Corps publications.

Whenever the fracture toughness of the steel is not documented, some testing will be necessary to determine the threat of brittle fracture at low temperatures.

## APPENDIX C DESCRIPTION OF INSPECTION TYPES

Excerpts from the Code of Federal Regulations  
23 Highways - Part 650

Subpart C National Bridge Inspection Standards (NBIS)

### 1. Inventory Inspections

*a.* An inventory inspection is the first inspection of a bridge as it becomes part of the bridge inventory, but the elements of an inventory inspection may also apply when there has been a change in the configuration of the structure (e.g., widenings, lengthenings, supplemental bents, etc.). The inventory inspection is a fully documented investigation performed by engineers and technicians meeting the required qualifications for inspection personnel; it must be accompanied by an analytical determination of load capacity. The purpose of this inspection is twofold. First, it is used to determine all data for the "Structure Inventory and Appraisal Form" described in Appendices F and G to this Engineer Regulation plus other data required for U.S. Army Corps of Engineers records. Second, it is used for the determination of baseline conditions and the identification and listing of any existing problems or locations in the structure that may have potential problems. Aided by a prior detailed review of plans, it is during this inspection that any fracture-critical members (or details) are noted for subsequent focus and that assessments are made of other conditions that may later warrant special attention.

*b.* If the bridge subjected to an inventory inspection is anything other than a newly constructed structure, it may be necessary to include some or all of the elements of an in-depth inspection.

### 2. Routine Inspections

*a.* This is a regularly scheduled, intermediate level inspection consisting of sufficient observations and/or measurements to determine the physical and functional condition of the bridge, to identify any developing problems and/or change from "Inventory" or previously recorded conditions, and to ensure that the structure continues to satisfy present service requirements.

*b.* The routine inspection must fully satisfy the requirements of this Engineer Regulation with respect to the maximum inspection frequency, updating of

structure inventory and appraisal data, and qualifications of inspection personnel. These inspections are generally conducted from deck, ground, and/or water levels, and permanent work platforms and walkways, if such are present. Special equipment (e.g. underbridge inspection equipment, rigging, or staging) is necessary for a routine inspection in circumstances where its use provides the only practical means of access to areas of the structure that are being monitored.

*c.* The results of a routine inspection are to be fully documented with appropriate photographs and a written report that includes any recommendations for maintenance or repair and for scheduling of follow-up in-depth inspections, if necessary. Load capacity evaluations will be provided to the extent that changed structural conditions would affect any previously recorded ratings.

### 3. Damage Inspections

These are unscheduled inspections to assess structural damage resulting from environmental or man-inflicted causes. The scope of inspection must be sufficient to determine the need for emergency load restrictions or closure of the bridge to traffic and to assess the level of effort necessary to effect a repair. The amount of effort expended on this type of inspection will vary significantly depending upon the extent of the damage. If major damage has occurred, inspectors must evaluate fractured members and section loss, make measurements for misalignment of members, and check for any loss of foundation support. A capability to make onsite calculations to establish emergency load restrictions may be necessary. This inspection may be supplemented by a timely in-depth inspection as described in paragraph (4) to document more fully the extent of damage and the urgency and magnitude of repairs. Proper documentation, verification of field measurements and calculations, and perhaps a more refined analysis to establish or adjust interim load restrictions are required for follow-up procedures. A particular awareness of the potential for litigation must be exercised in the documentation of damage inspections.

#### 4. In-Depth Inspections

*a.* An in-depth inspection is a close-up, hands-on inspection of one or more members above or below the water level to detect any deficiencies not readily visible using routine inspection procedures. Traffic control and special equipment (e.g. underbridge inspection equipment, staging, and workboats) should be provided as necessary to obtain access. Personnel with special skills such as divers and riggers may be required.

*b.* When appropriate or necessary to fully ascertain the existence of or the extent of any deficiency(ies), nondestructive tests and/or other physical and chemical tests may need to be performed.

*c.* The inspection may include a load rating to assess the residual capacity of the member or members, depending upon the extent of the deterioration or damage.

*d.* This type of inspection can be scheduled as a supplement to a routine inspection, though generally at a longer interval, or it may be a follow-up for damage or inventory inspections. It may include a diving inspection, if needed.

*e.* On small bridges, the in-depth inspection, if warranted, should include all critical elements of the structure, but for large and complex structures, these inspections may be scheduled separately for defined segments of the bridge or for designated groups of elements, connections, or details that can be efficiently addressed by the same or similar inspection techniques. If the latter option is chosen, each defined bridge segment and/or each designated group of elements, connections, or details will be clearly identified as a matter of record, and each will be assigned a frequency for reinspection. To an even greater extent than is necessary for inventory and routine inspections, the activities, procedures, and findings of in-depth inspections must be completely and carefully documented.

#### 5. Interim Inspections

*a.* Interim inspections are scheduled at the discretion of the individual responsible for bridge inspection activities. An interim inspection is used to monitor a particular known or suspected deficiency (e.g. foundation settlement or scour, member condition, the public's use of a load-posted bridge, etc.) and can be performed by any qualified person familiar with the bridge and

available to accommodate the assigned frequency of investigation. Under the NBIS qualification requirements for inspection personnel, the individual performing an interim inspection must be carefully instructed regarding the nature of the known deficiency and its functional relationship to satisfactory bridge performance. In this circumstance, guidelines and procedures on what to observe and/or measure must be provided, and a timely process to interpret the field results must be in place.

*b.* The determination of an appropriate interim inspection frequency should consider the severity of the known deficiency.

#### 6. Diving Inspection

*a.* A bridge shall require a diving inspection if it meets one or more of the following diving criteria:

(1) A bridge with any portion of a substructure exposed to water deeper than 1.8 m (6 ft) during periods of normal low water shall be designated for diving inspection.

(2) A bridge with any portion of a substructure exposed to water deeper than 0.9 m (3 ft), but no deeper than 1.8 m (6 ft), during periods of normal low water may or may not be designated as a bridge requiring inspection by divers depending on the judgment of the professional engineer in charge of diving inspection activity. In making this determination, the professional engineer shall take into consideration, among other factors, structure type, materials of construction, foundation type, footing location relative to channel bottom, known or suspected problems, waterway characteristics, superstructure and substructure redundancy, etc. In making this evaluation and resulting determination, existing bridge records, including existing inspection information, shall be reviewed.

(3) A bridge with no portion of any substructure unit exposed to 0.9 m (3 ft) or more of water during periods of normal low water will normally not be designated for diving inspection.

*b.* Diving inspections may be performed as part of a routine inspection, an in-depth inspection, a special inspection, or as an independent inspection effort. When making determinations on the need for a diving inspection, it must be recognized that bridges are constructed of differing structural configurations and

situated in widely varying environments. This results in varying degrees of inspection difficulty, complexity, structural redundancy, and structural sensitivity. Portions of the diving inspection criteria intentionally leave discretion to provide for proper bridge-by-bridge evaluation of the above and other factors in determining the need for a diving inspection. Diving inspections shall

be performed at maximum inspection intervals of 60 months. However, it shall be determined, on a bridge-by-bridge basis, if a "complete" or "partial" diving inspection is needed on a more frequent basis. If it is determined that more frequent diving inspections are needed, they shall be scheduled.

## APPENDIX D STATEMENT OF INSPECTION REVIEW AND APPROVAL

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### PART 1: TO BE COMPLETED BY THE DISTRICT OR OPERATING MSC

#### COMPLETION OF INSPECTION AND EVALUATION

The inspection and evaluation of the \_\_\_\_\_ (name) Bridge has been completed by a qualified inspection team according to the NBIS. The inspection report received an independent technical review by a qualified bridge engineer and all substantive issues arising during the review have been resolved to meet the provisions of PL 100-17 and existing USACE policy.

\_\_\_\_\_  
(Signature, P.E)  
Bridge Inspection Team Leader

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Signature, P.E)  
Technical Review Team Leader

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Signature, P.E)  
Chief, Engineering Division

*Note: After signed by Chief of Engineering, this report shall be forwarded to MSC for approval.*

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### PART 2: TO BE COMPLETED BY MSC

#### CERTIFICATION OF QUALITY ASSURANCE AND APPROVAL

The inspection, evaluation and review of the \_\_\_\_\_ (name) Bridge has been completed in accordance with the approved Quality Control Plan, and this report is approved as sufficient in accordance with ER 1110-2-111 for updating the data in the CEBIS, and for proceeding to budget, schedule and design all maintenance and rehabilitation work necessary to correct deficiencies which jeopardize the structural safety and integrity of the \_\_\_\_\_ (name) Bridge.

\_\_\_\_\_  
(Signature, P.E)  
Director, Engineering and Technical Services  
Directorate of MSC

\_\_\_\_\_  
(Date)

*Note: The MSC can modify this statement as appropriate if the MSC delegates approval authority to the District.*

## APPENDIX E

### INSPECTION REPORT FORMAT AND CONTENT

The report format for all U.S. Army Corps of Engineers (USACE) bridge inspections is described in this appendix. Such reports shall be prepared as follows:

*a. Front cover page.* The words “U.S. ARMY CORPS OF ENGINEERS” with the castle logo on top, shall be placed at the left-hand upper corner of the page. The bridge’s name and number, report number, and its location shall be centered on the front page. The report date and the division and district names shall be placed at the left and right lower corners, respectively, on the front page.

*b. First page.* The first page after the cover page shall be the “Statement of Inspection Review and Approval.” See Appendix D for more information.

*c. Second page.* The second page shall contain an executive summary of the report.

*d. Third page.* The third page shall be the Table of Contents. See page A-9, “Sample Bridge Inspection Report,” of reference 3*d*, for more information.

*e.* The main body of inspection reports shall follow the “Sample Bridge Inspection Report” from pages A-11 through A-26 of reference 3*d*. Estimated costs, a scheduled completion date of any remedial work, and a USACE Bridge Inventory System printout shall also be included in the report.

**APPENDIX F**  
**HIGHWAY BRIDGE STRUCTURE INVENTORY**  
**AND APPRAISAL (SI&A) SHEET**

SPECIAL CODING INSTRUCTIONS

The Federal Highway Administration (FHWA) publication "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges" shall be used for completion of the SI&A data form

shown in this appendix except for those items with numbers greater than 199. Numbers greater than 199 denote items unique to the Corps' inventory. These items are described in reference 3*n*.

## HIGHWAY BRIDGE STRUCTURE INVENTORY AND APPRAISAL

### \*\*\*\*\*IDENTIFICATION\*\*\*\*\*

- (1) STATE NAME - \_\_\_\_\_ CODE \_\_\_\_\_  
(200) COE DIVISION \_\_\_\_\_  
(201) COE DISTRICT \_\_\_\_\_  
(202) COE/DA BRIDGE NUMBER \_\_\_\_\_  
(8) STATE STRUCTURE NUMBER # \_\_\_\_\_  
(5) STATE INVENTORY ROUTE (ON/UNDER) \_\_\_\_\_  
      - (a), (b), ..., (e) \_\_\_\_\_  
(2) STATE HIGHWAY DEPARTMENT DISTRICT - CODE \_\_\_\_\_  
(3) COUNTY CODE \_\_\_\_\_ (4) PLACE CODE \_\_\_\_\_  
(6) FEATURES INTERSECTED - \_\_\_\_\_  
(7) FACILITY CARRIED - \_\_\_\_\_  
(9) LOCATION - \_\_\_\_\_  
(11) MILEPOINT \_\_\_\_\_  
(16) LATITUDE \_\_\_\_ . \_\_\_\_ . \_\_\_\_ (17) LONGITUDE \_\_\_\_ . \_\_\_\_ . \_\_\_\_  
(98) BORDER BRIDGE STATE CODE \_\_\_\_\_ % SHARE \_\_\_\_\_ %  
(99) BORDER BRIDGE STRUCTURE NO. # \_\_\_\_\_

### \*\*\*\*\*STRUCTURES TYPE AND MATERIAL\*\*\*\*\*

- (43) STRUCTURE TYPE MAIN: MATERIAL - \_\_\_\_\_  
      TYPE - \_\_\_\_\_ CODE \_\_\_\_\_  
(44) STRUCTURE TYPE APPR: MATERIAL - \_\_\_\_\_  
      TYPE - \_\_\_\_\_ CODE \_\_\_\_\_  
(45) NUMBER OF SPANS IN MAIN UNIT \_\_\_\_\_  
(46) NUMBER OF APPROACH SPANS \_\_\_\_\_  
(107) DECK STRUCTURE TYPE - \_\_\_\_\_ CODE \_\_\_\_\_  
(108) WEARING SURFACE/PROTECTIVE SYSTEM:  
  A) TYPE OF WEARING SURFACE - \_\_\_\_\_ CODE \_\_\_\_\_  
  B) TYPE OF MEMBRANE - \_\_\_\_\_ CODE \_\_\_\_\_  
  C) TYPE OF DECK PROTECTION - \_\_\_\_\_ CODE \_\_\_\_\_

### \*\*\*\*\*AGE AND SERVICE\*\*\*\*\*

- (27) YEAR BUILT \_\_\_\_\_  
(106) YEAR CONSTRUCTED \_\_\_\_\_  
(42) TYPE OF SERVICE ON \_\_\_\_\_  
      UNDER \_\_\_\_\_ CODE \_\_\_\_\_  
(28) LANES: ON STRUCTURE \_\_\_\_\_ UNDER STRUCTURE \_\_\_\_\_  
(29) AVERAGE DAILY TRAFFIC \_\_\_\_\_  
(30) YEAR OF ADT 19\_\_\_\_ (109) TRUCK ADT \_\_\_\_\_  
(19) BYPASS, DETOUR LENGTH \_\_\_\_\_ MI  
\*\*\*\*\*GEOMETRIC DATA\*\*\*\*\*  
(48) LENGTH OF MAXIMUM SPAN \_\_\_\_\_ FT  
(49) STRUCTURE LENGTH \_\_\_\_\_ FT  
(50) CURB/SIDEWALK: LEFT \_\_\_\_ . \_\_\_\_ FT/RIGHT \_\_\_\_ . \_\_\_\_ FT  
(51) BRIDGE ROADWAY WIDTH CURB TO CURB \_\_\_\_ . \_\_\_\_ FT  
(52) DECK WIDTH OUT TO OUT \_\_\_\_ . \_\_\_\_ FT  
(32) APPROACH ROADWAY WIDTH (W/SHOULDERS) \_\_\_\_ . \_\_\_\_ FT  
(33) BRIDGE MEDIAN - \_\_\_\_\_ CODE \_\_\_\_\_  
(34) SKEW \_\_\_\_\_ DEG (35) STRUCTURE FLARED \_\_\_\_\_  
(10) INVENTORY ROUTE MIN VERT CLEAR \_\_\_\_\_ FT \_\_\_\_\_ IN  
(47) INVENTORY ROUTE TOTAL HORIZ CLEAR \_\_\_\_ . \_\_\_\_ FT  
(53) MIN VERT CLEAR OVER BRIDGE RDWY \_\_\_\_ FT \_\_\_\_\_ IN  
(54) MIN VERT UNDERCLEAR REF - \_\_\_\_ . \_\_\_\_ FT \_\_\_\_\_ IN  
(55) MIN LAT UNDERCLEAR RT REF - \_\_\_\_ . \_\_\_\_ FT  
(56) MIN LAT UNDERCLEAR LT \_\_\_\_ . \_\_\_\_ FT

BRIDGE RECORD WAS UPDATED ON \_\_\_\_\_

\*\*\*\*\*

(App C) SUFFICIENCY RATING - \_\_\_\_\_  
      STATUS \_\_\_\_\_

\*\*\*\*\*

NOTE: ITEM NUMBERS CORRESPOND WITH THOSE USED IN THE  
FHWA NATIONAL BRIDGE INVENTORY EXCEPT FOR THOSE  
GREATER THAN 199, WHICH ARE UNIQUE TO THE USACE. ITEMS  
211 THROUGH 215 ARE ONLY FOR ARMY INSTALLATIONS.

### \*\*\*\*\*NAVIGATION DATA\*\*\*\*\*

- (38) NAVIGATION CONTROL - \_\_\_\_\_ CODE \_\_\_\_\_  
(111) PIER PROTECTION - \_\_\_\_\_ CODE \_\_\_\_\_  
(39) NAVIGATION VERTICAL CLEARANCE \_\_\_\_\_ FT  
(116) VERT-LIFT BRIDGE NAV MIN VERT CLEAR \_\_\_\_\_ FT  
(40) NAVIGATION HORIZONTAL CLEARANCE \_\_\_\_\_ FT

### \*\*\*\*\*CLASSIFICATION\*\*\*\*\*

- (112) NBIS BRIDGE LENGTH - \_\_\_\_\_ CODE \_\_\_\_\_  
(104) HIGHWAY SYSTEM - \_\_\_\_\_ CODE \_\_\_\_\_  
(26) FUNCTIONAL CLASS - \_\_\_\_\_ CODE \_\_\_\_\_  
(100) DEFENSE HIGHWAY - \_\_\_\_\_ CODE \_\_\_\_\_  
(101) PARALLEL STRUCTURE - \_\_\_\_\_ CODE \_\_\_\_\_  
(102) DIRECTION OF TRAFFIC - \_\_\_\_\_ CODE \_\_\_\_\_  
(103) TEMPORARY STRUCTURE - \_\_\_\_\_ CODE \_\_\_\_\_  
(110) DESIGNATED NATIONAL NETWORK - \_\_\_\_\_  
(20) TOLL - \_\_\_\_\_ CODE \_\_\_\_\_  
(21) MAINTENANCE RESPONSIBILITY - \_\_\_\_\_ CODE \_\_\_\_\_  
(22) OWNER - \_\_\_\_\_  
(37) HISTORICAL SIGNIFICANCE \_\_\_\_\_ CODE \_\_\_\_\_

### \*\*\*\*\*CONDITIONS\*\*\*\*\*CODE

- (58) DECK \_\_\_\_\_  
(59) SUPERSTRUCTURE \_\_\_\_\_  
(60) SUBSTRUCTURE \_\_\_\_\_  
(61) CHANNEL & CHANNEL PROTECTION \_\_\_\_\_  
(62) CULVERTS \_\_\_\_\_

### \*\*\*\*\*LOAD RATING & POSTING\*\*\*\*\*CODE

- (31) DESIGN LOAD - \_\_\_\_\_  
(64) OPERATING RATING - \_\_\_\_\_  
(66) INVENTORY RATING - \_\_\_\_\_  
(70) BRIDGE POSTING - \_\_\_\_\_  
(41) STRUCTURE OPEN, POSTED OR CLOSED - \_\_\_\_\_  
      DESCRIPTION - \_\_\_\_\_

### \*\*\*\*\*APPRAISAL\*\*\*\*\*CODE

- (67) STRUCTURAL EVALUATION \_\_\_\_\_  
(68) DECK GEOMETRY \_\_\_\_\_  
(69) UNDERCLEARANCES, VERTICAL & HORIZONTAL \_\_\_\_\_  
(71) WATERWAY ADEQUACY \_\_\_\_\_  
(72) APPROACH ROADWAY ALIGNMENT \_\_\_\_\_  
(36) TRAFFIC SAFETY FEATURES \_\_\_\_\_  
(113) SCOUR CRITICAL BRIDGES \_\_\_\_\_

### \*\*\*\*\*PROPOSED IMPROVEMENTS\*\*\*\*\*

- (75) TYPE OF WORK - \_\_\_\_\_ CODE \_\_\_\_\_  
(76) LENGTH OF STRUCTURE IMPROVEMENT \_\_\_\_\_ FT  
(94) BRIDGE IMPROVEMENT COST \$ \_\_\_\_ , \_\_\_\_ , 000  
(95) ROADWAY IMPROVEMENT COST \$ \_\_\_\_ , \_\_\_\_ , 000  
(96) TOTAL PROJECT COST \$ \_\_\_\_ , \_\_\_\_ , 000  
(97) YEAR OF IMPROVEMENT COST ESTIMATE \_\_\_\_\_  
(114) FUTURE ADT \_\_\_\_\_  
(115) YEAR OF FUTURE ADT \_\_\_\_\_

### \*\*\*\*\*INSPECTION\*\*\*\*\*

- (90) INSPECTION DATE \_\_\_\_/\_\_\_\_/\_\_\_\_ (91) FREQUENCY \_\_\_\_\_ MO  
(92) CRITICAL FEATURE INSPECTION: (93) CFI DATE  
  A) FRACTURE CRIT DETAIL - \_\_\_\_ - \_\_\_\_ MO A) \_\_\_\_\_  
  B) UNDERWATER INSP - \_\_\_\_ - \_\_\_\_ MO B) \_\_\_\_\_  
  C) OTHER SPECIAL INSP - \_\_\_\_ - \_\_\_\_ MO C) \_\_\_\_\_  
(203) INSP OFF \_\_\_\_\_  
(204) INSPECTOR \_\_\_\_\_  
(205) INSPECTION COST \_\_\_\_\_  
(211) MACON \_\_\_\_\_  
(212) INSTALLATION NAME \_\_\_\_\_  
(213) MILITARY LOAD CLASS WHEELED \_\_\_\_\_  
(214) MILITARY LOAD CLASS TRACKED \_\_\_\_\_  
(215) INSTALLATION NUMBER (IFS) \_\_\_\_\_  
(216) SEISMIC CATEGORY \_\_\_\_\_  
(217) ACCELERATION COEFFICIENT \_\_\_\_\_  
(218) SOIL SITE CONDITION \_\_\_\_\_

**APPENDIX G**  
**RAILWAY BRIDGE STRUCTURE INVENTORY**  
**AND APPRAISAL (SI&A) SHEET**

SPECIAL CODING INSTRUCTIONS

The Federal Highway Administration (FHWA) publication "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges" shall be used for completion of the SI&A data form

shown in this appendix except for those items with numbers greater than 199. Numbers greater than 199 denote items unique to the Corps' inventory. These items are described in reference 3*n*.

# RAILROAD BRIDGE STRUCTURE INVENTORY AND APPRAISAL

## \*\*\*\*\*IDENTIFICATION\*\*\*\*\*

(1) STATE NAME - \_\_\_\_\_ CODE \_\_\_\_\_  
(200) COE DIVISION \_\_\_\_\_  
(201) COE DISTRICT \_\_\_\_\_  
(202) COE/DA BRIDGE NUMBER \_\_\_\_\_  
(207) RAILROAD STRUCTURE NUMBER - # \_\_\_\_\_  
(5) STATE INVENTORY ROUTE (ON/UNDER)  
- (a), (b), . . ., (e) \_\_\_\_\_

(208) RAILROAD NAME - \_\_\_\_\_  
(6) FEATURES INTERSECTED - \_\_\_\_\_  
(7) FACILITY CARRIED - \_\_\_\_\_  
(9) LOCATION - \_\_\_\_\_  
(11) MILEPOINT \_\_\_\_\_  
(16) LATITUDE \_\_\_\_' \_\_\_\_' \_\_\_\_' (17) LONGITUDE \_\_\_\_' \_\_\_\_' \_\_\_\_'  
(98) BORDER BRIDGE STATE CODE \_\_\_\_\_ % SHARE \_\_\_\_%  
(99) BORDER BRIDGE STRUCTURE NO. # \_\_\_\_\_

## \*\*\*\*\*STRUCTURE TYPE & MATERIAL\*\*\*\*\*

(43) STRUCTURE TYPE MAIN: MATERIAL - \_\_\_\_\_  
TYPE - \_\_\_\_\_ CODE \_\_\_\_\_  
(44) STRUCTURE TYPE APPR: MATERIAL - \_\_\_\_\_  
TYPE - \_\_\_\_\_ CODE \_\_\_\_\_  
(45) NUMBER OF SPANS IN MAIN UNIT \_\_\_\_\_  
(46) NUMBER OF APPROACH SPANS \_\_\_\_\_  
(107) DECK STRUCTURE TYPE - \_\_\_\_\_ CODE \_\_\_\_\_  
(108) WEARING SURFACE/PROTECTIVE SYSTEM:  
(omit (a) and (b))  
C) TYPE OF DECK PROTECTION - \_\_\_\_\_ CODE \_\_\_\_\_

## \*\*\*\*\*AGE & SERVICE\*\*\*\*\*

(27) YEAR BUILT \_\_\_\_\_  
(106) YEAR CONSTRUCTED \_\_\_\_\_  
(42) TYPE OF SERVICE ON \_\_\_\_\_  
UNDER \_\_\_\_\_ CODE \_\_\_\_\_  
(28) TRACKS ON STRUCTURE - \_\_\_\_\_  
(29) AVERAGE DAILY TRAFFIC \_\_\_\_\_  
(30) YEAR OF ADT 19\_\_\_\_

## \*\*\*\*\*GEOMETRIC DATA\*\*\*\*\*

(48) LENGTH OF MAXIMUM SPAN \_\_\_\_\_ FT  
(49) STRUCTURE LENGTH \_\_\_\_\_ FT  
(50) CURB/SIDEWALK: LEFT \_\_\_\_' \_\_\_\_' FT/RIGHT \_\_\_\_' \_\_\_\_' FT  
(51) BRIDGE ROADWAY WIDTH CURB TO CURB \_\_\_\_' \_\_\_\_' FT  
(52) DECK WIDTH OUT TO OUT \_\_\_\_' \_\_\_\_' FT  
(34) SKEW \_\_\_\_ DEG (35) STRUCTURE FLARED \_\_\_\_\_  
(10) INVENTORY ROUTE MIN VERT CLEAR \_\_\_\_ FT \_\_\_\_ IN  
(47) INVENTORY ROUTE TOTAL HORIZ CLEAR \_\_\_\_' \_\_\_\_' FT  
(53) MIN VERT CLEAR OVER BRIDGE RDWY \_\_\_\_ FT \_\_\_\_ IN  
(54) MIN VERT UNDERCLEAR REF - \_\_\_\_ FT \_\_\_\_ IN  
(55) MIN LAT UNDERCLEAR RT REF - \_\_\_\_' \_\_\_\_' FT  
(56) MIN LAT UNDERCLEAR LT \_\_\_\_' \_\_\_\_' FT

\*\*\*\*\*

\*

BRIDGE RECORD WAS UPDATED ON \_\_\_\_\_

**NOTE:** ITEM NUMBERS CORRESPOND WITH THOSE USED IN THE  
FHWA NATIONAL BRIDGE INVENTORY EXCEPT FOR THOSE  
GREATER THAN 199, WHICH ARE UNIQUE TO THE USACE.

## \*\*\*\*\*NAVIGATION DATA\*\*\*\*\*

(38) NAVIGATION CONTROL - \_\_\_\_\_ CODE \_\_\_\_\_  
(111) PIER PROTECTION - \_\_\_\_\_ CODE \_\_\_\_\_  
(39) NAVIGATION VERTICAL CLEARANCE \_\_\_\_\_ FT  
(116) VERT-LIFT BRIDGE NAV MIN VERT CLEAR \_\_\_\_\_ FT  
(40) NAVIGATION HORIZONTAL CLEARANCE \_\_\_\_\_ FT

## \*\*\*\*\*CLASSIFICATION\*\*\*\*\*

\*  
(112) NBIS BRIDGE LENGTH - \_\_\_\_\_ CODE \_\_\_\_\_  
(21) MAINTENANCE RESPONSIBILITY - \_\_\_\_\_ CODE \_\_\_\_\_  
(22) OWNER - \_\_\_\_\_  
(37) HISTORICAL SIGNIFICANCE \_\_\_\_\_ CODE \_\_\_\_\_

## \*\*\*\*\*CONDITION\*\*\*\*\* CODE

(58) DECK \_\_\_\_\_  
(59) SUPERSTRUCTURE \_\_\_\_\_  
(60) SUBSTRUCTURE \_\_\_\_\_  
(61) CHANNEL & CHANNEL PROTECTION \_\_\_\_\_  
(62) CULVERTS \_\_\_\_\_

## \*\*\*\*\*LOAD RATING & POSTING\*\*\*\*\* CODE

(206) RATED COOPER'S E LOAD - \_\_\_\_\_  
(41) STRUCTURE OPEN, POSTED OR CLOSED - \_\_\_\_\_  
DESCRIPTION - \_\_\_\_\_

## \*\*\*\*\*APPRAISAL\*\*\*\*\* CODE

(71) WATERWAY ADEQUACY \_\_\_\_\_  
(72) APPROACH ROADWAY ALIGNMENT \_\_\_\_\_  
(36) TRAFFIC SAFETY FEATURES \_\_\_\_\_  
(113) SCOUR CRITICAL BRIDGES \_\_\_\_\_

## \*\*\*\*\*PROPOSED IMPROVEMENT\*\*\*\*\*

(75) TYPE OF WORK - \_\_\_\_\_ CODE \_\_\_\_\_  
(76) LENGTH OF STRUCTURE IMPROVEMENT \_\_\_\_\_ FT  
(94) BRIDGE IMPROVEMENT COST \$ \_\_\_\_\_, \_\_\_\_\_, 000  
(95) ROADWAY IMPROVEMENT COST \$ \_\_\_\_\_, \_\_\_\_\_, 000  
(96) TOTAL PROJECT COST \$ \_\_\_\_\_, \_\_\_\_\_, 000  
(97) YEAR OF IMPROVEMENT COST ESTIMATE 19/20\_\_\_\_  
(114) FUTURE ADT \_\_\_\_\_  
(115) YEAR OF FUTURE ADT 19/20\_\_\_\_

## \*\*\*\*\*INSPECTIONS\*\*\*\*\*

\*\*  
(90) INSPECTION DATE \_\_\_\_/\_\_\_\_/\_\_\_\_ (91) FREQUENCY \_\_\_\_MO  
(92) CRITICAL FEATURE INSPECTION: (93) CFI DATE  
A) FRACTURE CRIT DETAIL - \_\_\_\_-\_\_\_\_MO A) \_\_\_\_/\_\_\_\_  
B) UNDERWATER INSP - \_\_\_\_-\_\_\_\_MO B) \_\_\_\_/\_\_\_\_  
C) OTHER SPECIAL INSP - \_\_\_\_-\_\_\_\_MO C) \_\_\_\_/\_\_\_\_  
(203) INSP OFF \_\_\_\_\_  
(204) INSPECTOR \_\_\_\_\_  
(205) INSPECTION COST - \$ \_\_\_\_\_  
(209) RECOMMENDED SPEED LIMIT (MPH) \_\_\_\_\_  
(210) POSTED SPEED LIMIT (MPH) \_\_\_\_\_  
(216) SEISMIC CATEGORY \_\_\_\_\_  
(217) ACCELERATION COEFFICIENT \_\_\_\_\_  
(218) SOIL SITE CONDITION \_\_\_\_\_